

Vacuum Cleaner

This invention relates to a vacuum cleaner.

Known vacuum cleaners are either of the so-called upright type or the so-called cylinder type. Upright vacuum cleaners comprise an upright portion which is pivotally connected at its lower end to a wheeled floor-engaging portion, enabling partial rotation of the upright portion forwardly and rearwardly, relative to the floor-engaging portion, about a transverse axis. The upright portion encloses a motor/fan unit which draws air into a dust separation device through an inlet in the floor-engaging portion of the cleaner. A handle is provided at the upper end of the upright portion for manoeuvring the cleaner. A motor-driven rotary agitator brush is mounted across the inlet in the floor-engaging portion to beat and sweep the floor in the region of the airflow into the cleaner.

Cylinder vacuum cleaners comprise a body which encloses a motor/fan unit which draws air into a dust separation device through an elongate flexible hose. A plurality of tools are provided for fitting to the inlet end of the hose.

Upright vacuum cleaners are better at cleaning carpets than cylinder vacuum cleaners because of the action of the rotating agitator brush. However, cylinder vacuum cleaners are better suited for above-floor cleaning and for cleaning in places where an upright cleaner cannot be manoeuvred.

In order to provide a cleaner having the advantages of both upright and cylinder cleaners, it is known to provide an upright cleaner having an elongate flexible hose which can either be connected to the floor-engaging portion of the cleaner for conventional floor cleaning, or connected to an extension tube and/or selected cleaning tool for above-floor cleaning. A disadvantage of this arrangement is that during conventional floor cleaning, the airflow through the cleaner is partially restricted by the elongate flexible hose, which

is coiled for storage on the back of the cleaner. The coiled length of hose is also susceptible to blockage.

In order to overcome the above-mentioned problem, vacuum cleaners of the upright type are known which comprise  
5 a hose and a valve which can be actuated such that the suction is applied either to the hose for above-floor cleaning, or to the floor-engaging portion of the cleaner for conventional floor cleaning.

European Patent No. 0 037 674 discloses an upright  
10 vacuum cleaner of the above-mentioned type comprising an elongate rigid tube, which is mounted vertically to the rear of the cleaner body and which forms a handle for manoeuvring the cleaner during conventional floor cleaning. In this configuration, the elongate rigid tube is enclosed within an  
15 elongate flexible suction hose which is retracted to its minimum length, and which is connected at its lower extremity to one of the inlet ports of a two-way valve, the outlet port of which is connected to the inlet of a cyclonic separator. In order to carry out above-floor cleaning, the rigid suction tube  
20 is withdrawn from the retracted suction hose, the lower end of the tube and the distal end of the hose having fittings which effect an airtight connection between the two conduits when the tube is withdrawn from the hose to its fullest extent. The action of withdrawing the rigid tube from its conventional  
25 floor cleaning position actuates the two-way valve, to divert the suction airstream from the floor-engaging portion of the cleaner to the hose.

It will be appreciated that during conventional floor cleaning, when the elongate rigid tube is stowed on the cleaner  
30 body, the user has to grasp the upper end of the elongate rigid tube to manoeuvre the cleaner. When the rigid tube is disconnected for above-floor cleaning, this upper end of the tube becomes the distal end of the tube. However, since the upper end of the elongate rigid tube needs to be ergonomically  
35 shaped to provide a handle for manoeuvring the cleaner, it is

not practical to form the upper end of the tube of a shape which is instantly ready for above-floor cleaning when the elongate rigid tube is disconnected. Accordingly, prior to using the cleaner in the above-floor cleaning mode, the user firstly has to locate and then fit a tool to the upper end of the tube. This procedure is time consuming and makes it difficult for the user to swap conveniently and quickly between floor cleaning and above-floor cleaning.

We have now devised a vacuum cleaner which can be used for both floor cleaning and above-floor cleaning and which alleviates the above-mentioned problems.

In accordance with this invention, there is provided a vacuum cleaner comprising:

a floor-engaging portion having a first air inlet on the underside thereof;

an upright portion pivotally connected at its lower end to said floor-engaging portion;

a handle upstanding from the upper end of said upright portion and having a first end and a second end, said first end of the handle being detachably engaged with a formation on said upright portion;

a rigid tubular duct extending along the handle between a second air inlet at said first end thereof and an outlet disposed remote from said first end; and

an elongate flexible hose having a first end and a second end, the first end of the hose being connected to said outlet on said handle, wherein the cross-sectional area of the rigid tubular duct extending along the handle increases substantially from said second air inlet at said first end of the handle towards said outlet disposed remote from said first end of said handle, the rigid tubular duct having, at said first end of the handle, an elongate portion which has either a transverse dimension or a cross-sectional area which is substantially uniform over its length.

The elongate portion at the first end of the handle thus acts to form a narrow above-floor cleaning tool, which is already connected in-situ ready for use, thereby avoiding the need to connect a tool before above-floor cleaning can  
5 commence.

Preferably the cross-sectional area of duct in the elongate portion at the first end of the handle is 40%-60% less than the cross-sectional area of the duct adjacent said outlet of the handle.

10 Preferably the duct in the elongate portion at the first end of the handle comprises a major transverse axis which is at least 40% greater in length than its minor transverse axis lying perpendicular thereto. In this manner the tool provided at the first end of the handle has a substantially  
15 flat configuration.

Preferably said major transverse axis lies along a line which extends between the front and rear of the cleaner when said handle is engaged with the upright portion of the cleaner.

Preferably the duct adjacent said outlet of the handle  
20 is substantially circular in section.

Preferably the formation on the upright portion of the cleaner comprises a socket which is arranged to receive said elongate portion of the first or lower end of the handle.

Preferably this socket is arranged to conceal the first  
25 end of the handle and said second air inlet thereon. In this manner, the tool provided by the lower end of the handle is concealed from view when the cleaner is being used for floor cleaning.

Preferably the cleaner comprises a valve having a first  
30 inlet port fluidly connected to said first air inlet in said floor-engaging portion, a second inlet port fluidly connected to the second end of said elongate flexible hose, an outlet port connected to a dust separation device and means for selectively connecting said valve outlet port to either said  
35 first or said second valve inlet ports.

In use of the cleaner for floor cleaning, the valve is configured to apply suction to the first air inlet in the floor-engaging portion. The handle is then used to propel and guide the cleaner over the surface being cleaned.

5 To use the cleaner for above-floor cleaning, the handle is simply detached and the valve configured to apply suction to the second air inlet at the first or lower end of the handle via the elongate flexible hose.

Preferably the valve comprises an actuator arranged to  
10 configure the valve to connect said second air inlet to said dust separation device when the handle is removed from the upright portion and to connect said first air inlet to said dust separation device when the handle is engaged with said upright portion.

15 Preferably the handle comprises an elongate tubular structure of plastics material (comprising one or more tubular members), which is preferably closed at the second end of the handle is and is preferably shaped to provide a hand grip which can be grasped by the user.

20 Whilst the tool provided by the first end of the handle is always attached to the cleaner so that it is ready to use, means are preferably provided to allow a section of the lower end of the handle to be removed, in order to enable any blockages in the duct to be cleared.

25 Preferably a catch is provided to retain the handle in the socket of the upright portion of the cleaner, against a resilient bias. When the catch is released, the handle is biased out of the socket to a position where it is conveniently offered to the user for above-floor cleaning.

30 Preferably at the same time the valve is actuated to divert the suction from the first air inlet on the underside of the floor-engaging portion to the second air inlet on the handle.

An embodiment of this invention will now be described by way of example only and with reference to the accompanying  
35 drawings, in which:

Figure 1 is a side view of an upright vacuum cleaner in accordance with this invention, configured for floor cleaning;

Figure 2 is a side view of the vacuum cleaner of Figure 1, configured for above-floor cleaning;

5        Figure 3 is a longitudinal sectional view through the handle of the vacuum cleaner of Figure 1;

Figure 4 is a sectional view along the line IV-IV of Figure 3;

Figure 5 is a sectional view along the line V-V of  
10 Figure 3; and

Figure 6 is a schematic diagram to illustrate the principle of operation of a valve mechanism of the vacuum cleaner of Figure 1.

Referring to Figure 1 of the drawings, there is shown  
15 an upright vacuum cleaner comprising an upright portion 10 pivotally connected at its lower end to a floor-engaging portion 11, enabling partial rotation of the upright portion forwardly and rearwardly relative to the floor engaging portion 11, about an axis which extends transverse the cleaner. The  
20 upright portion 10 encloses a motor/fan unit and comprises a detachable handle 12 at its upper end for manoeuvring the cleaner over the surface being cleaned. A first suction inlet 13 is provided on the underside of the floor-engaging portion 11 and a motor-driven rotating agitator brush mounted (not  
25 shown) is mounted across the inlet 13.

A cylindrical separation unit 14 for separating dirt and dust from the airflow is mounted to the front of the upright portion 10 of the cleaner. A further handle 15 for carrying the cleaner is provided on top of the upright portion  
30 10 of the cleaner.

Referring to Figure 2 of the drawings, the detachable handle 12 is removably received in a vertical socket 16 formed in the rear of the upright portion 10 of the cleaner. The upper portion of the wall forming the socket 16 comprises a catch 17

which engages a barb 18 on the side wall of the handle 12 to retain the latter in the socket 16.

Referring to Figure 3 the drawings, the handle 12 is formed of three generally tubular members 19, 20, 21 of plastics material connected end-to-end. The first tubular member 19 is disposed at the upper end of the handle 12 and is shaped to provide a hand grip which the user can grasp when manoeuvring the cleaner during floor cleaning. An end cap 22 is fitted to the free end on the upper tubular member 19 to provide an upper end wall of the handle 12.

The lower end of the upper tubular member 19 is engaged to the upper end of an elongate central tubular member 20 having generally parallel sides. The lower end of the central tubular member 20 is detachably engaged to the upper end of lower tubular member 20 by fastenings 23.

An airflow duct 24 extends along the handle 12 from a second suction inlet 28, provided at the lower end of the handle 12, to an air outlet 25 provided in the side wall of the central member 20 of the handle 12, at a point adjacent the upper end thereof. The outlet 25 is coupled to the distal end of an elongate flexible hose 26, which extends from the upright portion 10 of the cleaner, as shown in Figure 2. A cranked tubular insert member 27 is disposed inside the handle 12 to direct air flowing up the handle 12 to the outlet 25 and to prevent any airflow into the upper member 19 of the handle 12, which member 19 forms the handgrip.

Referring to Figures 4 and 5 of the drawings, the duct 24 in the central member 20 of the handle is substantially circular in cross-section and has a cross-sectional area substantially equal to the cross-sectional area of the hose 26 and the other flow ducts leading to the motor/fan unit via the separation unit 14. However, the cross-sectional area of the duct 24 reduces along the tubular lower member 21 of the handle 12 from its upper end towards the second suction inlet 28 at the lower end of the handle. Typically, the cross-sectional

area of the duct 12 in the handle may reduce from 1800-2200 mm<sup>2</sup> adjacent the outlet 25 to 450-650mm<sup>2</sup> at the second suction inlet 28. Furthermore, the lower tubular member 21 comprises an elongate portion, adjacent the second suction inlet 28, which has a substantially uniform width w, substantially less than the width of the central tubular member 20. Typically, the width w of this elongate portion may be 60 to 75% less than the width of the central tubular member 20. The width w of the lower tubular member 21 is also substantially less than the orthogonal dimension d, at the second suction inlet 28, by a factor of say 40 to 60%. Whilst in the embodiment shown in the drawings the elongate portion of the duct 12, at the end of the handle, has a uniform transverse dimension or width w and an orthogonal dimension d which increases over its length, this portion may instead have a cross-sectional area which is uniform (e.g. both dimensions w and d remain uniform).

In this manner, the elongate portion at the lower end of the handle 12 provides a narrow so-called crevice tool which is normally attached to the handle, even when the latter is mounted to the cleaner, as shown in Figure 1, for conventional floor cleaning. Whilst the so-called crevice tool provided by the elongate portion at the lower end of the handle 12 is always attached to the cleaner so that it is ready to use, the fastenings 23 can be disconnected to allow the lower portion 21 of the handle 12 to be removed, in order to enable any blockages in the duct 24 to be cleared.

Separate tools, such as brushes and heads (not shown), may be carried on the cleaner for attachment to the crevice tool at the lower end of the handle 12.

Referring to Figure 6 of the drawings, when the cleaner is being used for conventional floor cleaning and the handle 12 is fitted in the socket 15, as shown in Figure 1, the lower end of the handle 12 abuts a member 30, which is disposed at the bottom of the socket 15 and which is biased upwardly by springs e.g. 31 mounted on respective lateral sides of the



socket 15. The underside of the member 30 is connected to a valve 32 by a linkage 33.

The valve 32 comprises a hollow body 34 having a first inlet port 35 connected to the first suction inlet 13 on the floor-engaging portion 11 of the cleaner and a second inlet port 36 connected to the proximal end of the elongate flexible hose 26. An outlet duct 37 is rotatably mounted within the body 34 and comprises one end provided with a seal 29 for selective alignment with one or other of said inlet ports 35,36. The opposite end of the of the outlet duct 37 of the valve 32 is connected via a flexible hose (not shown) to the motor/fan unit via the separation unit 14, which separates dirt and dust from the airflow.

The rotary outlet duct 37 is connected to the linkage 33, such that the outlet duct 37 of the valve 32 is connected to the inlet duct 35 when the member 30 is pushed down by the lower end of the handle 12 as the latter is fitted to the cleaner for conventional floor cleaning. The handle 12 is retained in the socket 15 against the resilient bias provided by the springs e.g. 31, by the catch 17 engaging the barb 18 on the handle 12.

In order to use the cleaner for above-floor cleaning, the user merely has to release the catch 17, which allows the handle 12 to move a small distance upwardly out of the socket 15 under the spring bias acting on the member 30. This upward movement of the member 30 actuates the linkage 33, which rotates the outlet duct 37 of the valve 32 to a position where the outlet duct 37 is connected to the inlet port 36 to which the hose 26 is connected.

Once released by the catch 17, the handle 12 is immediately and conveniently ready for use as a tool for above-floor cleaning without the user having to manually divert the suction or fit cleaning tools. The hose 26 is of the long-stretch type, which is able to extend to a length in excess of six times its retracted length. The arrangement of the cleaner

is ideally suited to stair cleaning, since the body of the cleaner can be left at the bottom of the stairs whilst the tool provided by the lower end of the handle 12 is used to clean the stairs.

5           The cleaner is easily reverted to floor cleaning by replacing the handle 12 in the socket 15 against the spring bias, acting on the member 30, until the catch 17 on the wall of the socket 15 engages the barb 19 on the handle 12, whereupon the valve 32 is actuated so that suction is diverted  
10 from the hose 20 to the to the suction inlet 13 in the floor-engaging portion 11 of the cleaner.

A vacuum cleaner in accordance with this invention is uncomplicated in construction yet can be simply and conveniently converted between floor and above-floor cleaning  
15 use.